Personal Control Over Heating, Cooling and Ventilation

results of a workshop at Clima 2013 conference

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Published in:
REHVA Journal

Publication date:
2013

Document Version
Publisher's PDF, also known as Version of record

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This article presents a summary of a Workshop at 11th Clima Wolrd Conference 2013 in Prague. The workshop was organised by REHVA in cooperation with ISIAQ (International Society of Indoor Air Quality and Climate), and chaired by Atze Boerstra and Angela Simone.

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Objectives

The main idea of the workshop was to gather the opinions and ideas amongst the workshop participants about personal control over indoor climate and user behaviour. The workshop followed the introduced program reporting in details below main results and discussions.

Core of the workshop (2/3 of the total time) was devoted to a guided group discussion, between the participants. The discussion evolved around several prepared statements which were presented one-by-one (by the moderators). Every time a statement was presented the participants voted to indicate whether they agreed or not. Individuals were pointed out to explain their positions further, which lead to an additional group discussion.

Below the **statements** that were discussed are presented, with a description of the general response and 'average' opinion given by the participants.

Statement #1. We know how building occupants use their adjustable wall-thermostats and other controls

The majority of the participants disagreed (90%). Examples given to prove that we still have limited knowledge about the use of controls (specifically adjustable thermostats) were:

- In open-plan office buildings occupants may not adjust the thermostat as they believe that the uncomfortable thermal sensation is too subjective and an adjustment may cause complaints between colleagues. Additionally, it seems a common experience that many people (notably women) do not have a good idea of the functionality of control devices.
- Residential buildings: the family often compare the use of the thermostats with the direct contact and perception and as a consequence they may adjust it wrongly. In fact, often people react to the instant

thermal sensation because they do not know the functionality of the HVAC system that is behind the control tool (it is not explained to them how the system works and how they can adjust it).

An additional opinion between the audience also raised the problem that often we don´t know where the thermostat is located and what it is really measuring. In fact, often it is attached to a wall at a very high place resulting in measuring some air temperature that is very different than the one perceived by the occupants (as proved in scientific studies).

Suggestion on the use and intrinsic logic design of smart phones was given for the HVAC professionals in order to use their knowledge and their experience to provide and adjust the environmental thermal conditions.

Statement #2. Occupant behaviour and man-environment interaction related to indoor climate is complex

75% of participants agreed with the statement, the rest didn´t express any opinion. The main comment was that the technical side of HVAC systems may be easy, but when looking at the interaction between building users and systems, physiology, psychology, sociology, etc., may exist between, making the task complicated. However, the occupants should be free in their natural behaviour as a consequence of the fact that adaptation and physiology reaction is very large. Even so, in the future better indoor environment should be provided.

Statement #3. 100% satisfaction over the indoor climate (and a PD of 0%) is possible

A long discussion followed on this statement as the participants were split (50/50) between agrees and disagrees. The main discussed point was to choose on what to focus: building systems or occupant satisfaction? Human should have a choice that have to adapt with the building systems and the human needs.

The main argument of those that agreed was based on few studies that showed that 100% of satisfaction can be achieved although, in that context, full control and local personalized environment must be provided to the occupant. From those that disagreed, it was believed that after some time of providing the perfect environment, human may start to complain, against any building service. In addition, psycho-social factors and other things that scientist still do not see may make it near impossible to create 100% of indoor climate satisfaction.

Statement #4. If you want to boost the productivity in an office building, give individual office workers control over their temperature and fresh air supply

In terms of productivity as function of temperature and fresh air controls the participants had very different opinions with 40% agreeing, 10% disagreeing and 50% that had no opinion. In particular, while 40% agreed, the rest 60% pointed out that other aspects also can influence productivity. The issues that should be considered could be different (e.g. solar shading control) and also connected to the temperature and fresh air supply control (e.g. size/location of the control). Also psycho-social aspects might play a role on the background.

Another considered aspect was the work distraction that the occupant can perceive when focusing at the different controls and spending time on adjusting them (or trying to adjust them). From that point of view, even if some scientists believe that occupants can learn and later have an easy fix of controls with high work productivity, others were more sceptic.

Statement #5. Building occupants want control over

Most of the attendants (95%) disagreed with the statement. Many participants stated: “as long as the thermal environment is in the range of comfort conditions, the users’ don´t want to have control”. This declaration was supported by real life experienced examples, e.g.: (1) in landscape offices, even if people feel the need to adjust the thermal environment they tend not to do it if they notice that the rest of the occupants are satisfied with the present conditions; (2) in homes or single office environments, people tend to act on the control more often to reach a comfort state, however usually they have other priorities (work, family, etc.) and don´t want to be bothered from a continuous room control need. Moreover, it was also noted that there are large difference between people: some want control no matter what others actually prefer. A conclusion was reached, that: “some building users may want to control their environment but certainly not all the time”.

Statement #6. HVAC engineers want control over building occupants at all times

Clearly 50% of the participants disagreed and only 10% agreed, 40% had no opinion. The 10% that agreed with the statement believe that HVAC engi-

neers would like to have some control over buildings and their occupants so that they can guarantee e.g. a certain energy performance. On the other side, who disagreed explained that the need of control is due to a possible control of project budget so that engineers can avoid occupants complains.

Statement #7. The average HVAC professional knows how to select an adjustable wall-thermostat

Most of the audience (80%) didn´t have an opinion; while the rest (20%) disagreed. The disagreements were explained by the not enough experience of HVAC professionals that seems everywhere daily visible (e.g. no-knowledge is shown by the location (height) or by the complexity of the installed thermostat). Everyone seems to agree that more should be done in training HVAC-professionals better in the selection and also in the installation of controls. Besides, developments of indoor environmental controls (as wall thermostats) should be supported for fast reading of the physical parameters that must be representative of the occupied zone (e.g.: read of perceived temperature by the occupant).

Statement #8. Operable windows should be avoided

No doubts that operable windows should be mandatory, as almost all the audience quickly disagreed with the statement (95%). The main argument was that it is not just important to offer control over the thermal environment but also over fresh air supply / indoor air quality. A participant mentioned that this can be provided by other means than operable windows (e.g. boost knobs that influence the fresh air supply by a mechanical ventilation system).

Statement #9. Buildings with a user-adjustable indoor climate are more expensive

At this point the audience split almost equally in three groups: 30% agreed, 30% disagreed, 40% had no opinion. Many ideas and opinions were shared between the participants while explaining the different points of view. Statements in terms of agreement and disagreement are presented in the following:

- ***Yes***, the building is more expensive and requires higher investment to provide more and adjustable personal controls. However, the building may also be cheaper, because the building owner will have an immediate return on investment due to higher productivity of the building's users,
- ***No***, the building is not more expansive because the choice of higher control level will allow higher comfort level, environment acceptability and healthier occupants.

The discussion was focusing on the fact that the price may be less relevant if results are perceived as important, e.g. more satisfied occupants.

Finally, the discussions turned on "Occupant Expectation", as earlier mentioned too. Occupants´ expectations in "expensive buildings" are usually high and to reach high levels of satisfaction possibilities for adjustable indoor climate should be provided. In "cheaper buildings" on the other side, occupants usually have fewer expectations, and they are more tolerant on the indoor environment. However, compromising with occupants´ satisfaction and acceptability in "cheaper buildings" is not always the best solution.

Statement #10. Including user control in HVAC system design will lead to higher energy use

About 40% disagreed; the rest mostly had no opinion. Discussion was mainly focusing on the estimation of the energy savings that may change in connection with low temperature setting in winter and higher temperature set in summer when using micro-acclimatisation systems. Conditions resulting from climate changes versus near zero energy buildings types are raising other issues as summer overheating for cold climate regions. At the end the group agreed to disagree meaning that the impact on energy use from inclusion of options for personal control depends very much from climate to climate, building design, etc.

Statement #13. There are business opportunities out there related to unfulfilled climate control needs

More than 90% of the participants agreed. There was general consensus that there are opportunities both in terms of products (e.g. more easy to use adjustable thermostats) and in terms of services (e.g. service contracts that include explanations and trainings to e.g. households on how to get the most out-off new complex energy systems for dwellings).

Statement #15. REHVA should produce a separate 'Personal Control Guidebook' with concrete examples on how to design user-adjustable heating, ventilation and cooling systems

A total of 80% agreed, one person was against, the rest had no opinion. A general conclusion was that it is worth investigating the feasibility of a new REHVA guidebook on the subject of personal control and user behaviour related to the design / installation of HVAC systems.

Final conclusion

Exchange of knowledge, experiences and ideas between HVAC designers, component manufactures, building service system scientists, and others, was the main idea of the workshop. Indeed the workshop resulted in very good and interactive discussions where different points of view were shared.

There was consensus that personal control over indoor climate and user behaviour in the context of design and operation of HVAC is an important issue which needs further attention within the HVAC community both in design and research. ■

The full version of the Workshop summary in published in the REHVA Report No 5, Sevela P, Aufderheijde J (Editors) REHVA Workshops at Clima 2013 – Energy efficient, smart and healthy buildings, 2013. Available at REHVA Bookstore at www.rehva.eu

News flash:

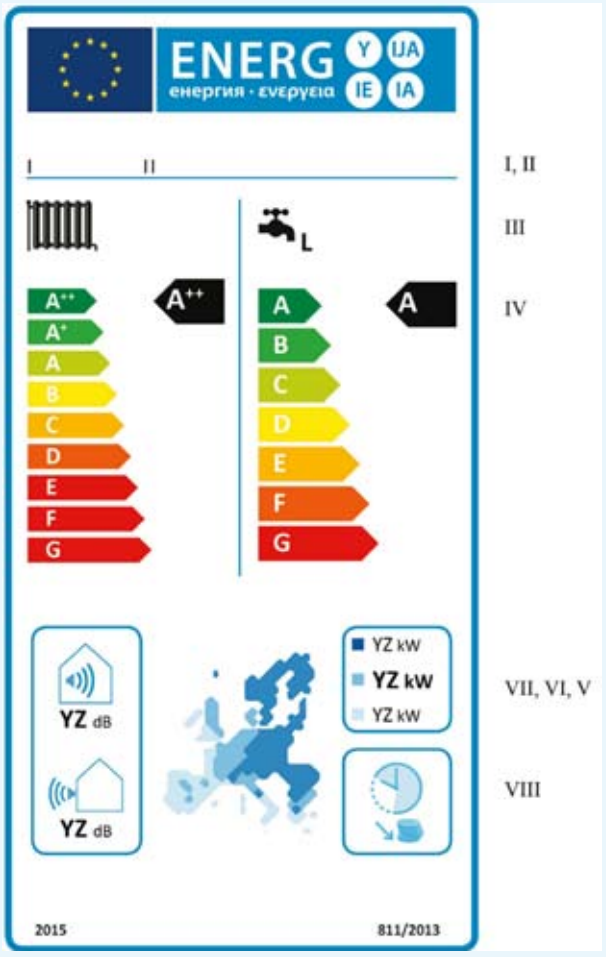
EU Regulations on space heaters and water heaters published on Sept 6th in the Official Journal of the European Union

After several years of discussions and preparatory work the Commission completed earlier this year the important regulations of space heater and domestic water heated like boilers, heat pumps and water tanks. The final versions of the Regulations were prepared at DG ENTER. The regulations are based on Energy Labelling and Eco-design of Energy Related Products Directives.

Regulations apply to all EU Member States without any further national legislation. The contetns of the Labelling Regulations was as agreed in February and the Eco-design regulations in August 2013. The technical contents of the boiler regulations were introduced to the readers of the REHVA Journal in the March issue of the REHVA Journal

The regulations include:

- Energy labelling of space heaters, combination heaters, packages of space heater, temperature control and solar device and packages of combination heater, temperature control and solar device
- Energy labelling of water heaters, hot water storage tanks and packages of water heater and solar device
- Ecodesign requirements for space heaters and combination heaters
- Ecodesign requirements for water heaters and hot water storage tanks



An example of the mandatory energy label for heat pump combination heaters in seasonal space heating energy efficiency classes A ++ to G and in water heating energy efficiency classes A to G.

The full text of the regulations is available in the Official Journal, totally 188 pages.